The Link between Coral Bleaching and Global Warming

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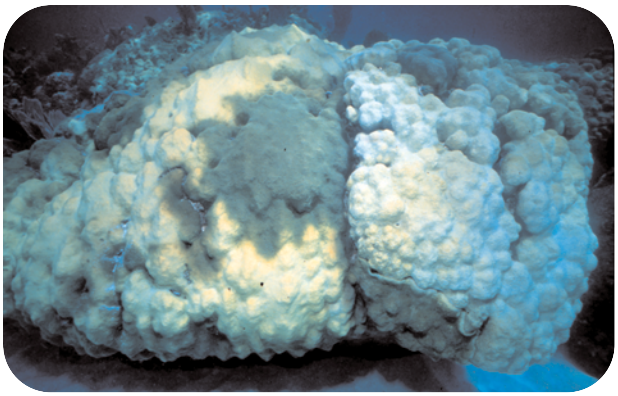
One might think that global warming would benefit the living coral reefs of the world. After all, corals thrive in subtropical climates with warm, clear water. But too much heat is not necessarily a good thing, as has been evidenced over the past several decades in the Florida Keys.

The tiny, individual polyps that comprise a coral colony require specific environmental conditions to live and grow, including clear, nutrient-poor water, sunlight, and moderate water temperatures. Increases in sea temperatures, if they are high enough, prolonged, or occur in concert with other stresses, can cause coral animals to expel the symbiotic algae living within their tissue, exposing the limestone coral skeleton. This phenomenon, known as "bleaching", leaves corals more susceptible to other stresses and may eventually cause death.



Bleaching in boulder star coral, *Montastrea annularis*, Key Largo in 1987.

In the past twenty years, coral bleaching in the Florida Keys and elsewhere around the world has increased. Two events first signaled problems in the Florida Keys. Those were a large die-off of barrel sponges on the outer reefs off Big Pine Key in 1978 and a Keys-wide die-off of reef fish along the outer reefs in 1980. Massive coral bleaching was first recorded in the Florida Keys in 1983 along the outer reef tract of the lower Keys. This event was preceded by periods of low wind and high air temperature, which likely contributed to localized increased sea temperature. Coral bleaching was next observed in July 1987, again following doldrum-like weather conditions. During this incidence, the outer reefs throughout the Florida Keys were afflicted, and secondary impacts such as coral diseases were observed. This was also the first time coral bleaching was reported on a global scale. In July 1990, bleaching exploded Keys-wide. Inshore reefs bleached for the first time on record, and coral mortality reached nearly 65% in some areas. Bleaching expansion and intensification in the Florida Keys continued with another massive episode in 1997 that affected inshore and offshore reefs. Lingering high water temperatures and a particularly strong El Niño event caused yet another bleaching event in 1998, before the reefs could adequately recover from the previous year's stress. Similar observations of bleaching have been made regionally and internationally since 1987, and it is widely recognized that 1997 and 1998 were the worst coral bleaching years on record causing significant loss of corals worldwide.

The pattern of geographical expansion and increased duration of coral bleaching presents compelling evidence that our coral reefs are responding to global climate change. In fact, coral bleaching episodes worldwide have coincided with the ten warmest years on record, which have occurred since 1983. Additionally, meteorological data indicate that our planet is experiencing the fastest global warming rate in 10,000 years and over the last century, average temperatures have increased by nearly 1°F. Temperatures are predicted to rise during the 21st century as atmospheric carbon dioxide emissions increase.

These alarming trends necessitate action if coral bleaching is to be curtailed. Globally, strict air pollution standards must be adopted, carbon dioxide emissions reduced, and renewable energy technologies employed. At the regional scale, elected officials and policy makers should work to conserve and protect watersheds, reduce emissions, and decrease energy use. Local communities that are culturally and economically supported by coral reefs, such as the Florida Keys, can focus efforts on improving water quality, eliminating physical impacts to corals, employing sustainable fishing practices, reducing pollution, and saving energy. Solutions exist and must be aggressively pursued and applied at many scales to slow warming trends. The Florida Keys National Marine Sanctuary is committed to doing its part to protect coral reefs locally while addressing regional issues and engaging leaders globally on climate change.

Note: This article appeared in the Spring 2001 issue of the newsletter of the Florida Keys National Marine Sanctuary, **Sounding Line**. *For more information, visit:* floridakeys.noaa.gov.